

SCIENCE

FRIDAY, AUGUST 10, 1888.

WHILE THE LACK of reliable information prevents us from gaining an understanding of Stanley's fate and the ultimate objects of his expedition, news has been received as to the events in Khartum. In May two messengers arrived in Cairo, carrying brief notes from Slatin Bey and several other European captives of the Mahdi. The handwriting of the writers was recognized by their friends, so that there can be no doubt as to their being genuine. The fate of the captives is pitiful. Only the missionaries are at liberty, and they are allowed to make a living by selling boiled beans in the streets of Khartum. Lupton Bey, formerly governor of the province Bahr-el-Gazel, was made to work in the armory like a common Arab. Recently he has been employed in the mint of the Mahdi. Slatin Bey is made the Mahdi's runner, and has to hold his stirrup. Others are imprisoned, and the Mahdi threatens to execute them. The messengers describe the state of affairs in the Mahdi's province as miserable. The inhabitants of Khartum are said to be starving, and there is a great want of clothing and of money. Discord prevails between the followers of the Mahdi and several chiefs. One of the latter recently tried to gain his independence, but as the Mahdi's party was more numerous he submitted. Although a formal peace was made, the Mahdi made the chief a prisoner and had him hanged. The messenger says that a force of five hundred men of Turkish or Egyptian troops approaching from Wadi Halfa would be able to destroy the Mahdi's power. The tribes of the Sudan are discontented with his rule, and after a short time he would find himself deserted by everybody, a few fanatics excepted. It is considered impossible to ransom the prisoners, as caravans conveying money or goods would be robbed and murdered before arriving in Khartum. Last year a sheik of Berber offered to re-open the trade between Khartum and Egypt. Although the Mahdi was not unwilling to accept the offer, his council rejected it. This news is considered reliable, and shows the difficulties which would be encountered in an attempt to liberate the unfortunate captives. Various letters of Emin Pacha confirm these reports, for he describes the effect of the despotic rule of the Mahdi about in the same way. In how far, however, the subjected tribes would be ready to assist in an attack upon the Mahdi appears doubtful, as we might else expect that they would join Emin, whose difficulties seem to be comparatively great. From recent reports it would seem that the Mahdi is contemplating a new attack upon the Equatorial Province, and that Emin is going northward to meet him. This news must be received with due reserve, as it does not agree with former letters of Emin and the apparent decline of the Mahdi's power. The despatch says, "Two native messengers who were captured from an earlier expedition by tribes in the Uganda district, bordering on the Albert Nyanza, and who escaped from their captors about the beginning of April, have just arrived here. They report that Emin Bey was in a situation of great difficulty. Provisions were scarce, and difficult to procure, and his troops were beginning to be discouraged. On April 4 Emin received a summons from the Mahdi, dated Khartum, calling on him to surrender and to disband his troops, the Mahdi threatening to attack if Emin refused." It will be remembered that Emin kept up friendly relations with Uganda and Unyoro up to the end of last year, and that he was able to purchase supplies in Uganda. In November, 1887, he sent letters from the southern part of Lake Albert Nyanza, and stated that he was extending the limits of his province southward. Since the unex-

pected retreat of the Mahdi during the great war in the Sudan, he has not been molested by serious attacks from the north.

AT LAST THERE IS REASON to hope that the publications of the Geological Survey will be printed. There are now in the hands of the public printer more than forty volumes prepared by the Geological Survey and the Bureau of Ethnology. Among these are the annual reports of the Geological Survey for 1886 and 1887. The 'copy' of that of 1888 is also nearly ready. The Government Printing-Office is full of work from all of the departments, and which has been ordered by Congress, and, as a rule, it is left to the discretion of the public printer as to the order in which the work shall be done. The work of the Geological Survey and Bureau of Ethnology has generally been postponed. The appropriation for the printing of the publications of these two offices for the present fiscal year has been made a specific one: it cannot be used for any thing else. This will cause the public printer to do the work in order to get the money. Provision has been made for the printing of fifteen thousand extra copies of the annual reports of the Geological Survey, and six thousand copies of the bulletins of the Bureau of Ethnology for last year and this. The prompt issue of the publications of these two offices is certain to make them more popular, and to commend them more strongly to Congress for liberal support. They have gone on in the past, year after year, expending large sums of money, and making very little show in the way of printed matter in return for it. But this has not been the fault of Director Powell or of his assistants. They have prepared a great mass of matter, but the public printer has allowed it to accumulate in his office without putting it into type. It is now expected that the arrears of this work will be brought up during the coming year. The volumes that will appear during the next twelve months contain a great fund of popular and scientific matter.

THE APPROPRIATION OF \$250,000 for the purpose of investigating the extent to which the arid region of the United States can be redeemed by irrigation, and the segregation of the irrigable lands, and for the selection of sites for reservoirs and other hydraulic works necessary for the storage and utilization of water for irrigation, and to make the necessary maps, which was attached to the sundry civil appropriation bill by the Senate, will be agreed to by the House. A careful canvass of the members shows that a sufficient number will vote for it, whether the committee report favorably or otherwise upon it. In authorizing the beginning of this important work, the government enters upon an enterprise of greater magnitude than any of the kind it has ever engaged in. Director Powell of the Geological Survey has estimated, that, of the arid region, now not susceptible of cultivation, fifteen per cent, or 150,000 square miles, or an area exceeding that of one-half the land now cultivated in the United States, may be redeemed. At thirty dollars an acre, which is a low estimate of the value of the rich lands of the West when plentifully supplied with water, this land, which is now worth almost nothing, would have a value of \$2,880,000,000. By comparison the building of the Pacific Railroad sinks almost into insignificance as a means of adding to the wealth of the nation.

THE CENSUS MAPS OF THE UNITED STATES.

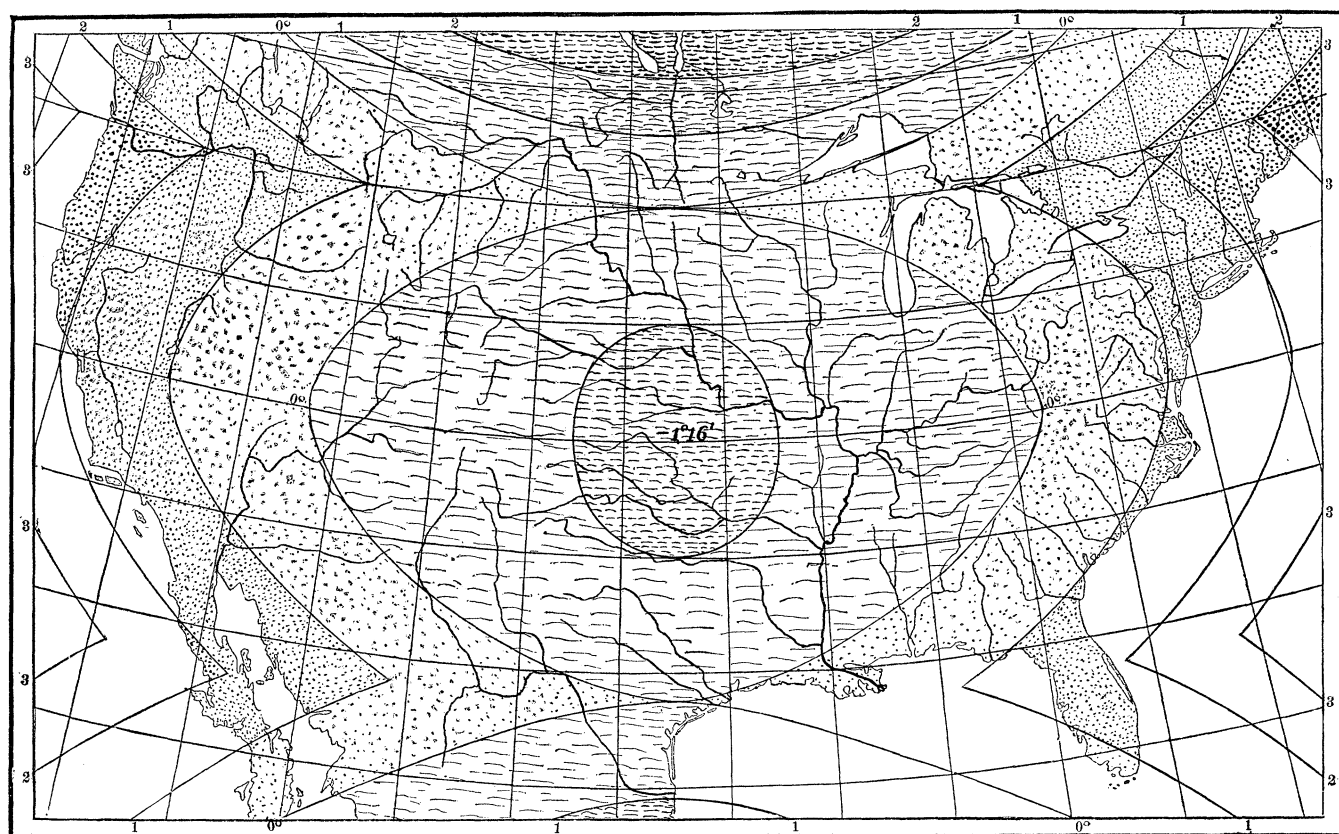
As the time is approaching for the Eleventh Census of the United States, the question whether the maps used for the purposes of the Tenth Census are satisfactory or not becomes impor-

tant and interesting. The making of a general map of the United States offers peculiar difficulties on account of the enormous size of the territory they occupy, which is so large that the curvature of the earth's surface has a very appreciable influence upon the map. This will be better understood by the fact that a circle circumscribed about the country cuts off a section of the globe of a little more than 42° aperture, its centre being situated north of Omaha. It is impossible to make a single map of the United States which in all its parts is an exact likeness of the country as it exists on the globe: therefore it is the task of the map-maker to find that method of projecting the country upon a flat piece of paper that results in alterations which are as slight as possible, and that agree best with the special object of the map.

We will consider in how far the existing maps satisfy this demand. On the accompanying map the polyconic projection of the Coast Survey which is in general use is shown in red. The lines of latitude and longitude are obtained in the following way. The portion of the globe situated between two parallels that are very

States with one another. But, besides this, the form of the single countries is distorted. We have indicated by arrows that direction in which the increase in the lengths of lines is a maximum. In the direction vertical to these arrows the decrease in the lengths of lines is a maximum. The distortion of each part of the map depends upon the relation of these two measures, and may be expressed by an angle. We observe on our map that this distortion exceeds 3° in the outlying parts of the country.

After having thus found the character of alterations in this map, we will proceed to consider whether it meets the demands that must be made upon such a map. The principal objection is, that the surfaces are very much enlarged in the outlying districts, which are at the same time among the most thickly settled. It is true that measurements may be made on sectional maps which have various central parallels; but when it is the object of the map to present at a single glance the relative extent of certain phenomena, of whatever character they may be, climatological, geological, or industrial, it is of prime importance that the surfaces in various parts



SKETCH-MAP OF THE UNITED STATES SHOWING THE DIFFERENCE BETWEEN THE DISTORTIONS IN THE POLYCONIC AND CONIC PROJECTIONS.

close together may be considered as part of a cone the apex of which lies on the axis of the earth. By developing this cone, the zone assumes the shape of a portion of a circular ring. One zone after another is thus developed. As the side of the cone varies according to the latitude of the zone, the rings do not exactly join each other; but this is remedied by enlarging the lengths of the meridians so as to fill up the gap. It will easily be understood that by this process those parts of the map lying far away from the central meridian will become distorted and too large. We will first study the enlargement of surfaces. On our map the lines on which the enlargement amounts to 1, 2, 3, 4, 5, and 6 per cent are indicated by heavy lines. Thus it will be seen, that while, in measuring a surface in the central points of the United States, we commit an error no greater than 1 per cent, the latter amounts to more than 6 per cent in the New England States and in California. If we have a large-scale map of the United States showing the distribution of forests, 10.6 square inches in New England will represent the same surface as 10 square inches in Minnesota. Thus we see that we cannot compare the surfaces of various parts of the United

of the map should be equivalent to each other. Maps which have this property are called 'authalic' or 'equivalent' maps, and we should say that it is the fundamental point that each map used for census purposes should be authalic.

But we might ask, if we agree that this should be the case, will not the alterations of angles become enormous, and thus our ideas of distances become altogether wrong? In order to satisfy this question, we must consider what means we have to preserve the same relation of surfaces all over the map, and at the same time to make the alteration of angles—and therefore that of distances also—as small as possible. We may first ask that this alteration be smaller than on the ordinary polyconic projection, and then we will have a map exceeding in value the former. But we present here a map that has not only slighter alterations of angles than the polyconic projection, but the surfaces of which are also preserved all over the map. While in the polyconic projection the alteration of angles very nearly reaches 4° , it does not exceed in our map $1^\circ 16'$. While the surfaces on the former projection are enlarged more than 6 per cent in the outlying regions, they are not at all altered

here. Besides this, the construction of the map is more simple than that of the polyconic map; the parallels being all concentric circles and the meridians straight lines, while in the polyconic projection each meridian must be constructed separately. But our projection has still another advantage; it is the best among all the authalic projections that are possible; that is to say, the maximum of distortion cannot be made smaller than it is in our map. A study of the map shows that the distortion reaches its maximum in the extreme southern part of the United States, in latitude 25° north, where it amounts to $1^{\circ} 16'$. Going north, it decreases rapidly, until in latitude $28^{\circ} 58' 49''$ it vanishes. Then it increases again quickly, and in $37^{\circ} 58' 16''$ again reaches its maximum of $1^{\circ} 16'$. Farther north it decreases, and on the parallel of $45^{\circ} 58' 55''$ there is no distortion. While in this zone (from $28^{\circ} 58' 49''$ to $45^{\circ} 58' 55''$) the maximum of increase of length is in the direction of the meridians, while the maximum of decrease is along the parallels, it is the reverse north and south of it. From the northern line, on which no distortion exists, it increases, and reaches $1^{\circ} 16'$ on the 49th parallel, the northern boundary of the United States. We have indicated by various shading the regions of equal distortion on both projections. The regions situated east and west of the line of $1^{\circ} 16'$ distortion on the polyconic map are in every respect inferior to our map. But it will be seen that the distortion of angles in the central part of the polyconic map is slighter than in our map. The central parts of our projection, on the other hand, are inferior to the polyconic projection so far as alteration of angles is concerned, while it is superior for census purposes as being equivalent. We must not, however, consider the central parts alone, as the map is intended as one of the United States, not of parts of the States. For the central parts alone, it would be necessary to adopt another equivalent projection. In our map on the lines of maximum distortion the lines whose lengths are increased are 1.1 per cent too long, while those vertical to them are 1.1 per cent too short: therefore this is the maximum error that can be made in measuring lengths. In the polyconic projection this error is equal to the amount of deformation of surface, being 6 per cent in the Eastern and Western States.

The sketch-map on p. 62 shows the difference between the distortions of angles in these two maps. In the shaded portions the polyconic projection has a slighter deformation of angles than our projection; in the dotted portions the reverse is the case. This comparison shows that in 48 per cent of the area of the United States the polyconic projection is superior to ours regarding deformation, the maximum difference in its favor being $1^{\circ} 16'$, while in 52 per cent of the area ours is superior, the maximum difference in its favor being nearly 4° . A comparison between the amount of deformation in both maps gives the following results:—

Deformation.	Per Cent of the Area of the United States.	
	Conic Projection.	Polyconic Projection.
$0^{\circ}-1^{\circ}$	51	58
$1^{\circ}-1^{\circ} 16'$	49	12
$1^{\circ} 16'-2^{\circ}$	—	15
$2^{\circ}-3^{\circ}$	—	13
$3^{\circ}-4^{\circ}$	—	2

From these remarks it appears that the conic projection excels the polyconic in every respect.

It appears from our map, very clearly, that the polyconic projection has the valuable property of having very slight distortions on a wide belt situated on both sides of the central meridian. This property makes it valuable for maps showing narrow strips of land only, such as coasts of the ocean and of lakes: therefore it is serviceable for the purposes of the Coast Survey, particularly as the alteration of surface is of little or no importance to the mariner. The United States, however, have a wide extent in longitude, and a far smaller one in latitude, which makes the projection not well adapted for a map of the whole country. If the object were to construct a map of the whole territory of the United States on this projection, we ought to make use of this fact. Our country is far

more extended in longitude than in latitude. But by assuming a system of parallels and meridians the pole of which is situated near latitude 12° north, longitude 175° west from Greenwich, and using this for a polyconic projection, the greatest distance from the new central meridian will be 13° instead of 30° , and the greatest distortion less than 1° instead of nearly 4° , while the increase of surface will be less than two per cent in the outlying portions. This projection may be considered quite a good one, as the central part of the country adjoining about the 40th parallel of latitude would have hardly any distortion. From this line it would increase very slowly northward and southward.

We said, however, above, that, for the purposes of a census, equivalence of surfaces must be the fundamental point of view for the construction of a map, and, as even the oblique projection just mentioned is not equivalent, it cannot be accepted. For the same reason it is necessary to take into account the spheroidal shape of the earth, which makes the computation of oblique projections difficult: therefore they will be only chosen if they offer great improvements upon others.

Assuming the central point of a circle circumscribed about the United States as a zenith, and computing a conical projection that is equivalent, and in which the alteration of angles is as slight as possible, we shall find that the maximum alteration of angle is not more than $58'$, the map including the whole territory of the United States. We should recommend this map, if it were not for the fact that there would be an open sector of 10° aperture running from the centre near Omaha to the northern boundary. This is produced by the development of the cone upon which the map has been projected. The existence of this open sector is so serious an objection, that the decrease of $18'$ in the deformation cannot be considered an equivalent.

By assuming an oblique conic projection the alteration of angle might be reduced to $1^{\circ} 9'$, but the difficulty of computing this projection for the spheroid induces us to discard it. A thorough investigation into the properties of all known projections leads us to the conclusion that the projection we propose here is the best that is possible for census purposes, and the only one that ought to be used for it. The easiness of computation of the elements adds to the properties that qualify it for an extensive use. DR. F. BOAS.

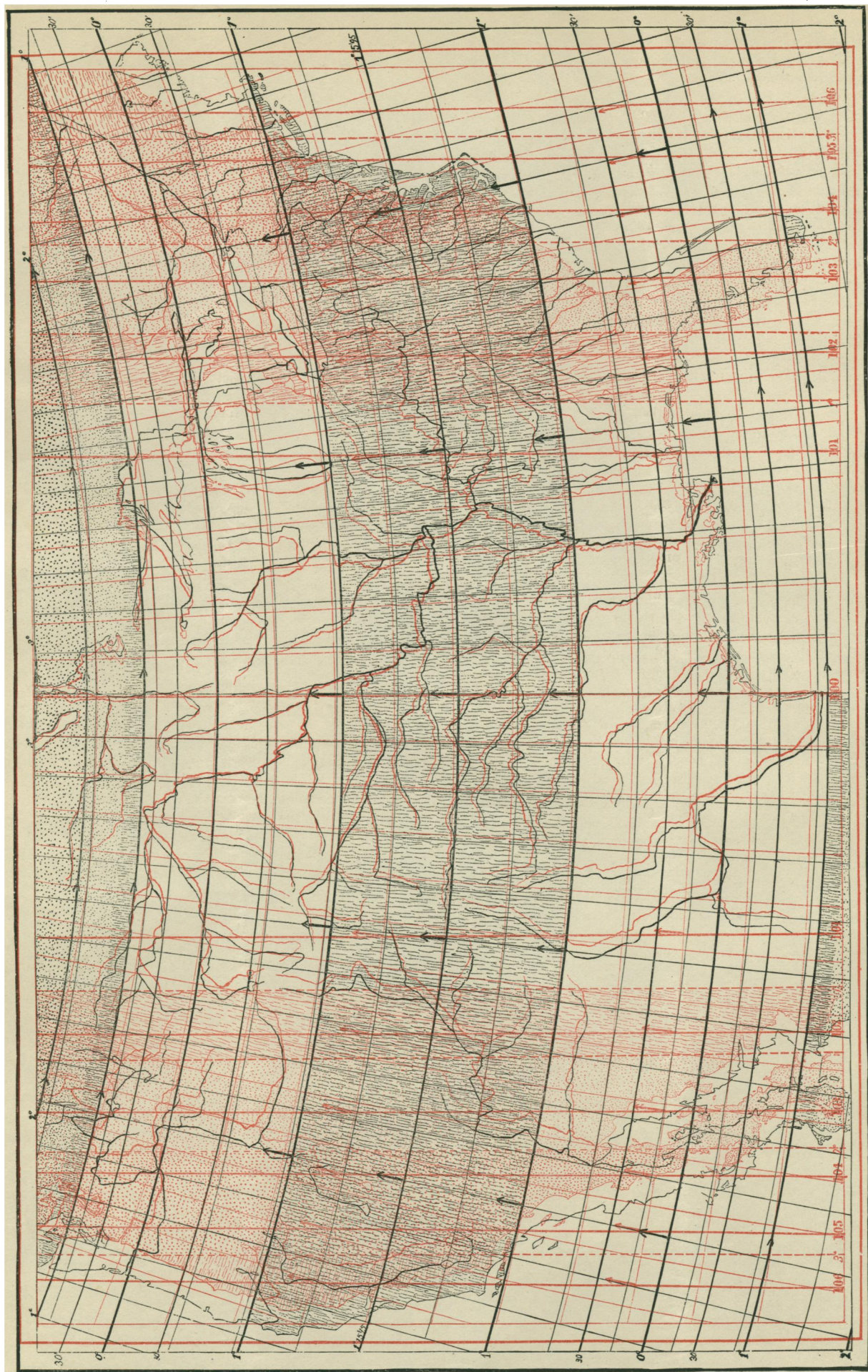
JAMES STEVENSON.

IN the death of James Stevenson on Wednesday, July 25, the public lost the services of one of the most active and indefatigable ethnologists of the time. Certainly, so far as knowledge of the aboriginal American race habits and customs is concerned, he contributed more than any predecessor, and by his keen appreciation of the subject and tireless investigation he saved from irreparable loss much of the evidence upon which must stand all we know of many of the ancient peoples of this continent and their polity.

From an article in a recent issue of the *National Tribune* of Washington we get the following facts relating to the life and labors of Mr. Stevenson. He was born at Maysville, Ky., in 1840, and his life was devoted to the one passion of geographical and ethnological research, except when interrupted by the war.

He went West first when quite a boy, several years prior to the Rebellion, with Professor Hayden, to the Missouri River country, making unofficial observations of Indian customs, and learning their dialects. Upon the breaking-out of the war, Professor Hayden entered the service as a surgeon, and young Stevenson enlisted as a private, and became a second-lieutenant of the Thirteenth New York Volunteers. He was at the second Bull Run, and was an important witness in the famous Fitz-John Porter case.

In 1866 he resumed his explorations, going to the Bad Lands of Dakota with Professor Hayden, as his assistant in the Geological Survey. Being a warm personal friend of the late Gen. John A. Logan, young Stevenson aroused in him a deep interest in the subject of developing a better knowledge of our Western lands. Logan, at Stevenson's suggestion, conceived the idea of establishing such a survey as a distinct and responsible branch of the general government, and from his place on the floor of the House, in the winter of 1866-67, he offered an amendment to the Sundry Civil Bill appropriating the sum of five thousand dollars for such an in-



Polyconic Projection in Red.

Conic Projection in Black.

— BY —
N. F. BOAS.

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vestigation, to be made by D. F. V. Hayden. This was adopted after a warm debate, and from this small beginning the present extensive and efficient organization known as the United States Geological Survey took its origin, and its growth upwards was due almost wholly during 1868 to 1872 to Stevenson's careful management. In 1867 and 1868 he again went with the annual expeditions, the work during these two summers being chiefly in Nebraska. In 1869 he took a trip along the eastern slope of the Rocky Mountains in Colorado and New Mexico. In 1870 the party went out on the Platte and into the Green River basin.

In 1871 Professor Hayden's party made the first geological surveying trip into the Yellowstone Park; and Stevenson, as usual, went along, acting as executive officer and general manager as well as collector in his own field. They took a pack train at Bozeman and an escort of cavalry from Fort Ellis. In 1872 the Hayden survey again went into the park, in two parties this time. They rendezvoused at Ogden and divided; the main party, under Professor Hayden, going in from the north by Bozeman, as before.

Stevenson went to Fort Hall and organized the Snake River expedition, which entered the park from the south by way of the Teton Mountains. On this expedition he ascended the great Teton, and nearly lost his life through slipping and falling several hundred feet on the snow, but miraculously escaped, and persisted in an effort to reach the summit, which he accomplished. It is not known that any other white man ever set foot upon the peak. He verified an Indian tradition by finding on the mountain-top an ancient stone altar.

He joined Professor Hayden's party at Yellowstone Lake, after which they again separated, each going out in the direction by which he had entered.

The season of 1873 again found Stevenson in the field, collecting and acting as executive officer for Hayden's surveying party in Colorado; and for the three following years his work was a repetition of this experience, and in the same field. In 1877 they went to Idaho, Wyoming, and Utah, and in 1878 to Yellowstone Park once more. On this trip Mr. Stevenson made a most complete collection of those specimens of the phenomena of the Geysers, which may be seen at the Smithsonian and National Museum in Washington.

In this connection it is worthy of mention that the first hydrographic survey of the Yellowstone Lake, which was made in 1871 and published by Henry W. Elliott, assisted by Campbell Carrington, United States Geological Survey, names the largest island in that remarkable body of water 'Stevenson Island,' and the loftiest peak that overlooks it 'Mount Stevenson.' This was done by Elliott in spite of Stevenson's strong disinclination to have it so recorded. He was always modest and retiring in so far as his own individuality was concerned. Thus his name is perpetuated by the largest island in that beautiful lake and one of the highest peaks on the east side of that famous park.

In 1879 the Hayden Survey was disbanded, and the Bureau of Ethnology was organized. Major Powell, the director, at once appointed Stevenson as a specialist in ethnological work, and he began an investigation, which has made him noteworthy, among the Pueblos of the Rio Grande and at Zuñi. During this year and the next, and again in 1881, he made an exhaustive collection of pottery, costumes, and ceremonial objects. Among the rest, he secured from the Zuñis a complete collection of their animal fetiches held sacred by them, and never before allowed to go out of their possession. During 1881 he also visited the Moqui Pueblo, making vast collections of objects illustrating both the ancient and modern life of the race.

The annual report of the bureau for 1881 contains an exhaustive descriptive catalogue of his collections among these Pueblos.

In 1882 he was off again, this time to explore the remains of the cliff and cave dwellers in New Mexico and Arizona at Cañon de Chelly and Cochiti, bringing back, among other things, two perfect ancient skeletons found in the largest of the cave-dwellings of the prehistoric inhabitants. From 1883 to 1885 he continued in this work, and in 1886 he paid a visit to the Mission Indians of California. By his familiarity with the inner life of these races he was enabled to discover, that, although these Indians had been ostensibly Catholics for two centuries, still at heart they were yet Pagans,

and worshipped and sacrificed to the gods of their forefathers in secret.

During the trip of 1885 he contracted the worst type of that peculiar 'mountain fever' which is so well known and dreaded in the high mesas of Arizona and New Mexico. He fought it off, however, after a severe siege of illness. It was the first real sickness that he ever had in his life, for he possessed a fine physique, and was remarkably temperate and regular in his diet and living.

Last year he returned to the New Mexico region, exploring and collecting, and renewed that wretched fever which finally destroyed the tissues of his heart, so that when he returned last December he was literally prostrated. He made, however, an heroic struggle for his life, and, growing worse as time passed on, he was advised to go to Gloucester, Mass., to spend the summer, and was on his way back from there, accompanied by his wife, when overtaken by death in New York.

His remains were taken to Washington, and after appropriate ceremonies were interred at Rock Creek Cemetery, just outside of the Soldiers' Home.

It is to be regretted that he did not write more; but the fact is, he had little time for that purpose. But as an original investigator, whose results some other hand must record, he was and is justly famous.

He left some manuscripts, however, which will have a lasting interest, one of which is upon 'The Mythologic Painting of the Navajos,' which, with the rest, will no doubt appear in due time in the publications of the bureau.

Mr. Stevenson was a man of singular firmness and rare amiability. He had an intuitive appreciation of men and what they really amounted to. This faculty made him one of the most efficient and prompt managers of the varied men of the survey, as they were despatched into the field with their outfits every spring, and recalled from it every fall.

SCIENTIFIC NEWS IN WASHINGTON.

A New Way of using Oil to calm the Troubled Sea. — How a Mound was made: Interesting Discoveries in Ohio by Mr. Gerard Fowke of the National Bureau of Ethnology. — How the Monthly Pilot Chart is made, and What it shows.

Oil-Exploding Rockets.

THE pamphlet describing and explaining the exhibit sent to Cincinnati by the Hydrographic Office of the Navy Department, which is now ready for the printer, contains a description of an oil-exploding rocket invented by Mr. W. Missel of the German steamer 'Werra,' and forwarded by Lieutenant Cottman, U.S.N., in charge of the branch hydrographic office, New York. The following extracts are made: —

"It is stated that experiments have been made with this rocket at sea and on shore which have proved very successful, particularly those by the German life-saving stations. Trials were made during a fresh wind and moderate sea off the mouth of the Elbe, and the rockets were exploded outside the breakers, in the breakers, and inside of the same. Outside the breakers, oiled areas of about three hundred feet long and nearly one hundred feet wide formed and calmed the sea very much, and remained a long time on the surface of the water. Those which exploded among the breakers exercised a remarkable quieting effect, and gave evidence of their value in facilitating the handling of lifeboats in case of shipwreck, as the resulting oil areas will enable the boat to get through the breakers without shipping water.

"A trial was made at sea on board the 'Werra' by firing a rocket from the bridge directly against the wind. It flew directly ahead against a wind whose force was 9, and the oil cylinder exploded in the water. The oil at once smoothed the sea, the heavy waves facilitating its rapid spread, and no seas were seen to break within the oiled area.

"Above the rocket composition the shell is prolonged $1\frac{1}{2}$ inches to receive the oil cylinder, which contains within it an exploding chamber filled with powder. Some loose powder is poured on top of the fuze composition, and the cylinder then shipped on the rocket. The stick is weighted with lead to balance exactly, so as to prevent trembling. All being ready, the rocket is set off from a tube, and

follows the direction given it. The burning composition finally reaches the loose powder, and the flame is communicated through a small hole in the bottom of the cylinder to the bursting charge of powder within the exploding chamber, the cylinder is thrown forward and exploded, and the oil spread upon the surface of the water."

How a Mound was built.

"While exploring mounds in Ohio this season, under the direction of the National Bureau of Ethnology," says Mr. Gerard Fowke in a paper prepared for *Science*, "I used great care in the examination of one mound in Pike County, in order to ascertain, if possible, the exact method of its construction.

"The mound was built upon the site of a house, which had probably been occupied by those whose skeletons were found. The roof had been supported by side-posts, and at intervals by additional inner posts. The outer posts were arranged in pairs a few inches apart, then an interval of about three feet, then two more, and so on. They were all about eight inches in diameter, and extended from two and a half to three feet into the ground, except one a few feet from the centre, which went down fully five feet. All the holes were filled with the loose dark dirt which results from decay of wood; a few contained fragments of charcoal, burned bones or stone, but no ashes; nor was the surrounding earth at all burned.

"Around the outside a trench from three to four feet wide, and from eighteen to twenty inches deep, had been dug, to carry away the water which fell from the roof. Near the middle of this house, which measured about forty feet from side to side, a large fire had been kept burning for several hours, the ashes being removed from time to time. The ash-bed was elliptical in form, measuring about thirteen feet from east to west, and five from north to south. Under the centre of it was a hole, ten inches across and a foot deep, filled with clean white ashes in which was a little charcoal, packed very hard. At the western end, on the south side (or farthest from the centre of the house), was a mass of burned animal bones, ashes and charcoal. This was continuous with the ash-bed, though apparently not a part of it. The bones were in small pieces, and were, no doubt, the remains of a funeral feast or offering.

"After the fire died down, rude tools were used to dig a grave at the middle of the house. It measured ten feet in length, from east to west, by a little more than six in breadth. The sides were straight, slanting inward, with rounded corners. The bottom was nearly level, fourteen inches deep, but slightly lower at the centre. Over the bottom, ashes had been thinly sprinkled, and on these a single thickness of bark had been laid. The sides had been lined with wood or bark from two to four inches thick. When this was done, two bodies were placed side by side in the grave, both extended at full length on the back, with heads directly west. One, judging from the bones and condition of the teeth, was a woman of considerable age. She was placed in the middle of the grave. Her right arm lay along the side, the left hand being under the pelvic bones of the other skeleton. This was apparently of a man not much, if any, past maturity. The right arm lay across the stomach, the left across the hips. This skeleton was five feet ten inches in length; the other, five feet four inches.

"The space between the first skeleton and the south side of the grave was covered with the ashes that had been removed from the fire. Beginning at the feet in a thin layer, — a mere streak, — they gradually increased in thickness toward the head, where they were fully six inches thick. The head was embedded in them. They extended to the end of the grave, reaching across its entire width, and coming almost, but not quite, in contact with the other head. A considerable amount of the burned bones lay in the south-western corner of the grave, and the ashes along this part curved up over the side until they merged into what remained of the ash-bed. This had extended to the west slightly beyond the end of the grave.

"As the earth removed from the grave had been thrown out on every side, the bodies were in a hole that was nearly two feet deep. The next step was to cover them. There was no sign of bark, cloth, or any other protecting material above them. They were covered with a black sandy earth, which must have been brought from the creek not far distant. This was piled over them while

wet, or at least damp enough to pack firmly, as it required the pick to loosen it, and, besides, was steeper on the sides than dry dirt would have been. It reached just beyond the grave on every side, and was about five and a half feet high, or as high as it could be conveniently piled.

"So far, all was plain enough; but now another question presented itself that puzzled me not a little; and that was, what became of the house? That there had been one, the arrangement of the numerous post-holes plainly showed; but the large earth-mound above the tumulus or grave was perfectly solid above the original surface, giving not the slightest evidence that the posts or any part of the house had ever reached up into it. I incline to the opinion that the great fire near the middle of the house had been made from the timbers composing it; that the upper timbers had been torn down, and the posts cut off at the surface, the whole being a kind of votive offering to the dead. At any rate, it is plain that a house stood there until the time the mound was built; and it was not there afterwards.

"For the purpose of covering the grave, sand was brought from a ridge a short distance away. There was no stratification, either horizontal or curving. Earth had been piled up first around the black mass forming the grave-mound, and then different parties had deposited their loads at convenient places, until the mound assumed its final conical arrangement. The lenticular masses through almost the whole mound showed that the earth had been carried in skins or small baskets. The completed mound was thirteen feet high, and about one hundred feet in diameter.

"Two and a half feet above the original surface was an extended skeleton, head west. It lay just east of the black earth over the grave. Sixteen feet south of the grave, on the original surface, and within the outer row of post-holes, were two skeletons extended, heads nearly west. It would seem that the flesh was removed before burial, as the bones were covered with a dull-red substance, which showed a waxy texture when worked with a knife-blade.

"No relics of any description were found with any of the skeletons; but a fine copper bracelet was picked up in a position that showed it was dropped accidentally."

The Pilot Chart of the North Atlantic Ocean.

The Pilot Chart is published by the Hydrographic Office on the first day of every month, and, although reference is frequently made to it in the daily and weekly press, no comprehensive description of it, its scope and objects, and the method of its preparation, has been written previous to a paper read a few months ago, and recently published by Mr. Everett Hayden, in charge of the Division of Marine Meteorology of the United States Hydrographic Office. In the following abstract are presented the essential parts of Mr. Hayden's paper.

The base of the Pilot Chart, the permanent portion which does not change from month to month, is simply a track chart of the North Atlantic on Mercator's projection. This is lithographed in black. Near the top is a compass-card, which the navigator uses to lay off his course; and in the lower left-hand corner, a storm-card, which illustrates the circulation of the wind around an area of low barometer, with brief practical rules for action to avoid the dangerous portions of an approaching cyclone. Light curved lines cross the chart, showing the variation of the magnetic compass, and a light dotted line near the coast is the hundred-fathom line. Small arrows indicate the general drift of ocean-currents. All of this is printed in black, and is not changed from month to month.

The portion of the chart printed in blue comprises essentially a meteorological forecast for the month following the date of issue, and in addition to this there are plotted the principal steamship and sailing routes recommended for the month. Small circles and arrows plotted uniformly over the chart indicate graphically the probable percentage of calms, and the frequency and force of the prevailing winds in each five-degree ocean square. There being no fixed meteorological stations on the high seas, it is necessary to group together observations made on board vessels in some way by which they can be localized and averaged up. This is done by dividing up the ocean into squares bounded by five degrees of latitude and longitude; and every vessel which goes through one of these squares and keeps meteorological observations adds to the

existing knowledge of the prevailing weather conditions in that square. It therefore happens that there are many squares whose meteorological conditions are very well known, on account of the very great number of vessels which traverse them; while, on the contrary, there are other squares which lie off the tracks of commerce whose meteorological conditions are only approximately known. In addition to this graphic representation of the frequency and force of prevailing winds in each ocean square, there is printed a brief forecast and a table showing the normal reading of the barometer, arranged in tabular form by ocean squares. A double dotted line near Newfoundland shows the probable limit of the region of frequent fogs for the coming month, and dotted lines across the lower parts of the chart indicate the limits of the trade-winds. Where the north-east and south-east trade-winds meet, there is the region of equatorial rains, indicated on the chart by a blue belt of irregular shape, lying principally north of the equator. These constitute the blue data or portions of the chart.

The portions of the chart printed in red comprise information collected during the month preceding the date of issue. On the ocean are plotted the latest reported positions of derelict vessels, wrecks and drifting buoys. Dotted lines indicate the drift which each wreck has followed since it was first reported. There are also plotted the positions where whales and waterspouts were reported during the previous month, and a red belt off Newfoundland indicates the region where frequent fogs were encountered. In the lower right-hand corner is printed a brief weather review of the preceding month, written at the last moment before going to press, but necessarily more or less incomplete so far as the entire Atlantic is concerned. Above is a large amount of printed matter, comprising a list of notices to mariners issued during the previous month, dangerous obstructions to navigation along the coast, charts published and cancelled, transatlantic steamship and sailing routes, the latest reported positions of logs from the big lumber raft which was abandoned off Nantucket, and various other matter likely to be of timely interest. To one who is not familiar with the subject it would seem almost impossible to publish on one chart such a variety of information of such a diverse character, and yet have a chart that can be of practical use in plotting a vessel's track. It would be very difficult to do without the distinction of colors.

In describing the methods by which the data for the Pilot Chart are collected from masters of vessels, Mr. Hayden referred to the branch hydrographic offices established in Boston, New York, Philadelphia, Baltimore, New Orleans, and San Francisco. At these offices masters of vessels can find all the latest nautical information—charts, light-lists, sailing directions—for every ocean of the globe, and standard barometers and thermometers for purposes of comparison. The naval officer in charge of such a branch office, during his three-years' tour of shore duty, is thrown into intimate relations with the owners, agents, and especially with the practical and energetic masters, of merchant vessels of every description, to mutual advantage, and to the benefit of both the commercial marine and the naval service. Mr. Hayden referred for illustration to the working of the branch office established in the Maritime Exchange, New York, which Lieut. V. L. Cottman, U.S.N., during the few years he has been in charge, has brought into a position of usefulness commensurate with the vast shipping interests of the great commercial metropolis of the United States. In a single year (1886-87), 6,739 vessels were visited, nautical information furnished to 83,345 masters of vessels and others, 10,397 Pilot Charts distributed, and 3,601 special detailed reports of marine meteorology forwarded for use in the preparation of the Pilot Chart alone, in addition to all the regular office-work, of which this is but a small fraction.

ELECTRICAL SCIENCE.

Change of Potential in a Voltaic Couple by Variation of Strength of the Liquid.

DR. G. GORE, F.R.S., read before the Royal Society, June 14, a communication on the above subject. A voltaic couple, consisting of zinc and platinum in distilled water, was opposed to a thermoelectric pile, the latter being regulated until there was no deflection of a galvanometer in the circuit. To the distilled water there was

added potassic chlorate, potassic chloride, hydrochloric acid, or bromine, in gradually increasing quantities, and the change in the electro-motive force of the voltaic couple was measured in each case. The following are the minimum proportions of the above substances required to change the potential of the couple in water: potassic chlorate, between 1 in 221 and 1 in 258 parts of water; potassic chloride, between 1 in 695,067 and 1,390,134; hydrochloric acid, between 1 in 9,300,000 and 9,388,188; of bromine, between 1 in 77,500,000 and 84,545,000 parts. With each of these substances a gradual and uniform increase of the strength of the solution from the weakest to a saturated solution was attended by a more or less irregular change of electro-motive force.

By plotting the results in curves,—the quantities of dissolved substance as ordinates, the electro-motive forces as abscissæ,—each substance will yield a different curve, the form of which is characteristic of the substance.

As a very slight addition of a foreign substance greatly changes the 'minimum point,' and alters the curve of variation of potential, the two may probably be used as tests of the chemical composition of the substance, and as a means of examining its state of combination when dissolved.

THE 'MINIMUM POINT' OF CHANGE OF POTENTIAL OF A VOLTAIC COUPLE.—Dr. Gore, at the same meeting of the Royal Society, described experiments made to determine the minimum amount of any substance that would affect the electro-motive force of a voltaic cell. To do this he arranged two magnesium-platinum couples in distilled water, and opposed them to each other with a sensitive galvanometer in their circuit. He then added known quantities of the substances to be investigated to one of the cells, and noted when the balance between the two couples was upset. The results were as follows: potassic chloride, between 1 part in 3,875 and 4,650 parts of water; potassic chlorate, between 1 in 4,650 and 5,166; hydrochloric acid, between 1 in 516,666 and 664,285; chlorine, between 1 in 15,656,500,000 and 19,565,210,000. The proportion required of each of these different substances is dependent upon very simple conditions,—unchanged composition of the voltaic couple, uniform temperature, and the employment of the same galvanometer. If a more sensitive galvanometer was employed, of course the numbers would be increased, but they are relatively correct. With constant conditions, the numbers obtained may possibly be used to test the purity or the uniformity of composition of the dissolved substances. The 'minimum point' varies with (1) the chemical composition of the liquid; (2) the kind of positive metal; (3) to a less degree with the kind of negative metal; (4) the temperature at the surface of the positive metal, and that of the negative one; (5) with the galvanometer used. The degree of sensitiveness is related to the degree of free chemical energy of the liquid, also to the atomic and molecular weights of the dissolved substances. The greater the degree of the free chemical energy of the dissolved substance, and the greater its action upon the positive metal, the smaller the proportion of it required to change the potential. As the 'minimum point' of a substance dissolved in water is usually much altered by adding almost any soluble substance to the mixture, measurements of that point in a number of liquids at a given temperature, with the same voltaic pair and galvanometer, will probably throw some light upon the degree of chemical freedom of substances dissolved in water.

ELECTRICAL TREATMENT OF ZINC AND ITS ORES.—Mr. Alexander Watt has brought forward a process of purifying and reducing zinc that promises to be largely used. In the purifying process the zinc is made the anode in a bath containing an organic acid, and is dissolved and deposited upon the cathode. Acetic acid is generally used in the process, the ordinary commercial acid being mixed with water in the proportion of one to two. The impure zinc plates are suspended in the bath, and the pure zinc is deposited on thin zinc plates, or on copper or iron plates coated with plumbago. When the operation is finished, the cathode plates are washed, and melted into ingots. To reduce the ores of zinc, especially the carbonate, the minerals are first reduced to a powder, and then submitted to the action of the acid, being added a little at a time. When the zinc is completely dissolved, the liquid is allowed to stand, and is then drawn off, and mixed with water in equal pro-

portions. In electrolyzing this liquid the anode plates are carbon, platinum, or some other substance not acted on by the acid: the cathode plates are zinc, carbon, etc. To keep the saturation constant, and to prevent polarization from an excess of free acid, Mr. Watt has devised a system of circulation by which the used-up liquid is restored to its original density in special reservoirs, and is used over and over again. In the treatment of blende or native sulphate of zinc, the ores are first roasted, after which they are pulverized and put in acid, as has been described. The process is said to be more economical than those now in use, but it has not been tested by experiment on a large scale.

ELECTRIC TESTING BUREAU AT JOHNS HOPKINS UNIVERSITY.—In a circular that has just been issued by the Johns Hopkins University is the announcement that an electric testing bureau is to be opened from Sept. 1. The circular, besides the announcement, gives the general methods of measurement that are to be employed. Such a bureau has been needed for some years. With the rapid increase in the number and importance of the applications of electricity in this country, the necessity of more accurate methods of measurement has become more and more apparent. In order that such measurements shall be uniform and comparable, they must be in terms of the same standards, and these standards should be referred to the system of absolute units, whose adoption has been of such benefit to physical science. The instruments in use for commercial measurements have constants that are liable to change in time; and electrical resistances, especially those used in accurate researches, should be carefully compared with standards. But besides the comparison of instruments and resistances, tests of batteries, dynamos, motors, etc., are to be made. This is an especially valuable feature, for almost every day brings the invention of some new storage or primary battery, dynamo, or motor, and it is not often that the inventor is in position to accurately test the value of his invention. For those who wish to develop any new discovery, it would be well to have some place of reference, where its value and possibilities can be impartially determined. The establishment of similar bureaus in France, Germany, Austria, and England has called attention to the necessity of something of the kind here. The applications of electricity in this country are much more important and extended than in any other, and it is to be hoped that this new departure will aid in their development. The Johns Hopkins University seems especially fitted to undertake the work; for, besides the excellent equipment of the laboratories, the institution has been more or less identified with accurate measurements since the classical determination of the mechanical equivalent of heat, made in 1878 by Professor Rowland. More lately important experiments have been made on the determination of the ohm, and the specific resistance of mercury. The list of prices given in the circular is reasonable, and the bureau should be well patronized.

HEALTH MATTERS.

Malaria.

THE subject of malaria and its causation was thoroughly discussed at the last meeting of the American Medical Association. One of the contributions was from the pen of Dr. Henry B. Baker. His conclusions were as follows: 1. Intermittent fever is proportional, directly or inversely, to the average daily range of atmospheric temperature. 2. The controlling cause of intermittent fever is exposure to insidious changes in the atmospheric temperature. 3. In the mechanism of the causation of intermittent fever the chief factor is the delay in the re-action to exposure to cool air: this delay, extending to a time when greater heat loss should occur, results in the abnormal accumulation of heat in the interior of the body and in disturbed nervous action,—the chill; and the final re-action is excessive, because of the accumulation of heat, and sometimes because it occurs at the warmest part of the day. 4. The fever is the excessive re-action from the insidious influence of the exposure to cool air; and it is periodical because of the periodicity of nervous action, and because the exposure and the consequent chill are periodical, owing to the absence of the warmth

from the sun at night. 5. Residence in valleys or on lowlands through which or upon which cold air flows at night, and thus causes insidious changes in the atmospheric temperature, favors intermittent fever. 6. In our climate those measures, such as drainage, which enable the soil to retain warmth during the night, and thus reduce the daily range of temperature immediately over such soil, tend to decrease intermittent fever among residents thereon. 7. In the cure and prophylaxis of intermittent fever, those remedies are useful which lessen torpidity (especially of the liver) and tend to increase the power of the body to re-act promptly to insidious changes in atmospheric temperature.

A paper entitled 'Malaria and the Causation of Fever in the State of New York' was presented by Dr. A. N. Bell of Brooklyn. As a result of his observation and study, he concludes that malaria is coincident with accumulations of organic matter in process of putrefaction in alluvial bottoms, on the margins of sluggish streams, low humid borders of stagnant ponds and lakes, the marshy borders of the seashore, and circumscribed local conditions, chiefly artificial, comprehending more or less the same relations to vegetable *débris* and other organic matter in process of decay as the outlying conditions mentioned in this connection. While it is not possible in the present state of our knowledge to determine the special relations existing between malarial diseases and the geological, thermal, hygrometrical, and barometrical conditions under which they occur, those thermal and hygrometrical conditions most promotive of putrefaction coincident with the absence of sunlight are in the highest degree promotive of malarial poison.

Prof. Tommasi Crudeli sent a letter to the association, expressing the opinion that it was impossible for a person to have ague without the presence in his body of the *bacillus malarie*. Dr. Bernardo Schiavuzzi of Pola, in a written communication, expressed himself a believer in this bacillus, and supported his belief by a statement of experiments on rabbits. Professor Laveran sent a paper on the *hematozoon malarie*.

CANCER.—The fatal result which almost inevitably attends cancer has caused investigators to search with unremitting zeal for a specific. This search is now prosecuted with more hopefulness than ever, by reason of the belief in many minds that cancer is a specific disease depending on a germ for its causation. One of the remedies from which much was expected was Chian turpentine. Although this has had its advocates in the past, it has never sustained a very high place in the profession generally. Recently it has again come into favor, principally through the reported cures occurring in the practice of Professor John Clay, obstetric surgeon to the Queen's Hospital, Birmingham, England. In these reports are included cases of cancer of the uterus, rectum, and skin. At the same time a trial of the remedy at the London Cancer Hospital has been made, with conflicting results. Dr. Daniel Lewis, surgeon to the New York Skin and Cancer Hospital, reports hopefully of the remedy, but in a communication to the *New York Medical Journal* says that he has been using it in too limited a number of cases to decide as to its curative properties. Chian turpentine is the product of a tree, the *Pistacia terebinthus*, which grows on the island of Scio in the Mediterranean. The turpentine, as it comes to this country, is a soft solid, becoming brittle when exposed to the air. It has an agreeable odor, somewhat like that of turpentine, and very little taste. The remedy is given in the form of an emulsion with mucilage of acacia, a solution of the turpentine having first been made with sulphuric ether.

TYPHOID FEVER.—The Paris correspondent of the *New York Medical Journal* reports that Professor Proust, who holds the chair of hygiene at the faculty of medicine there, has been giving a series of lectures on epidemics of typhoid fever and other diseases provoked by the ingestion of meat from diseased animals. One of the most important questions raised is that of whether it has been established that typhoid fever is a specific malady, caused by a certain organism called Eberth's bacillus. In Paris this doctrine has for the most part been accepted since the late studies made by Professor Brouardel and Dr. Chantemesse, who showed that this bacillus could be traced to the water-supply. It will be remembered, however, that Murchison held that the typhoid contagium could be developed in any putrid matter, and by this theory it is

easy to explain how meat could be infected by the typhoid element ; but if we accept the bacillus as the sole specific cause, and reject the pythogenic theory, which attributes the generation of the contagium to the fermentation of faecal matters independently of any specific germ, we must prove that these epidemics were caused by meat containing the bacillus first seen by Klebs and then by Eberth, and lately found in the living body by Chantemesse and Widal in Paris. But this is far from proved. Chauveau and No-card, who are among the most celebrated of French physiologists occupied with the study of animals, state that they do not believe in the existence of typhoid fever in animals. Walder, however, while making an autopsy of a heifer during the epidemic at Kloten, saw that the animal had tumefaction and softening of the mesenteric ganglia and of Peyer's patches, the latter presenting signs of ulceration. A second animal examined presented the same lesions, and both belonged to a farmer who had the fever himself. It was thought, however, that these animals had had access to matters coming from the family who were ill with the fever, and also to matters coming from autopsies made on other animals. In any case, Walder sought to prove that animals could take typhoid fever. The modern progress of bacteriological study will allow us to prove the existence of Eberth's bacillus in man, as well as in animals, in case of an epidemic ; but quite recent observations seem to show that different bacilli may produce typhoid states in both man and animals, so that the question is not as yet settled. There have been five well-known epidemics where typhoid symptoms resulted from the ingestion of meat in Switzerland since 1839, when it commenced at Andelfingen, up to Kloten in 1878, and Würenlos and Spreitenbach in 1880-81. In the first, some 450 persons were attacked, and over 700 at Kloten. Both of these epidemics followed great dinners given by musical societies, and the meat eaten was veal. The symptoms were those of typhoid fever, with the usual thermometric rise and fall so well described by Wunderlich. The autopsies made showed also the usual signs found after typhoid fever. The matter is important enough to make us insist on the fullest examination of all meat exposed for sale.

A SIMPLE FILTER.—Dr. F. A. Castle of New York thus describes, in a letter to the *New York Medical Journal*, a simple, and, as he claims, efficient filter: "For a long time I have used in my butler's pantry a simple contrivance for filtering water used on the table, which has been so serviceable, and at the same time so inexpensive, that I venture to recommend it. I took an ordinary glass pharmaceutical percolator, and packed the outlet with absorbent cotton so tightly that the water could only flow in drops. By means of a piece of copper wire for a bale, it was suspended from a hook on the lower side of one of the pantry shelves, over the shelf of the sink. As often as necessary, water is poured into the percolator, and the water-pitcher is placed under the outlet. Whenever the cotton shows much discoloration, — a thing which is easily observed, owing to the percolator being of glass, — the maid replaces it with fresh absorbent cotton. It is in all respects the most practical and cheapest filter I know of, and has no machinery to get out of order, no patent right to carry, and the advantage over most filters that the filtering medium is always under observation, so that there is little risk of contamination of the water by accumulations of filth."

PRECAUTIONS IN BATHING.—We have already called attention in *Science* to the danger of injury to the ear in bathing as described by Dr. Samuel Sexton. The London *Lancet*, in the following language, directs attention to still another danger. The bathing season, though not yet advanced, has already been marked by the levy of that fatal tribute which year by year is exacted of the ignorant and the indiscreet. The recent death by drowning of a young man in the public baths at Poplar suggests one cause of accident which is too apt to be overlooked. The deceased had entered the water soon after partaking of a hearty meal, and the fatal result was attributed to cerebral congestion due to sudden immersion at such a time. What may have been the particular appearances observed after death in this case we have no means of judging, but it may be well to consider shortly some reasons why the practice of bathing soon after meals is justly condemned. Effusion of blood in or upon the brain, when it occurs in such cases as that

already referred to, is probably not a primary cause of mischief, but rather a consequence founded on other circulatory and nervous disturbances. It is an evidence of eclampsia, and the physiological basis upon which this is founded consists in that inward diversion of blood toward the alimentary tract which characterizes normal digestion ; the other tissues, notably the brain, being at the same time proportionally anæmic, and the action of heart and lungs impeded by a distended stomach. A natural result of cold immersion at this stage is to encourage or induce a tendency to syncope, to concentrate surface blood still more about the central organs, including the heart, which, especially if at all unequal to its duties, labors ineffectually to re-adjust the blood-pressure, and finally succumbs with lungs and venous system engorged by passive congestion. It is as if an enemy occupied the outworks of a fortress left for a time unguarded, and forthwith paralyzed the resistance of the citadel. It is best, therefore, to wait for at least an hour and a half or two hours after a good meal before bathing. Another danger to be avoided is that of cramp. This is particularly apt to occur after severe exercise or long immersion. The effect of cold being to prolong the contraction, while exhaustion lowers both the power and the elastic recoil of muscle, it is evident that we have in a combination of these forces all that is required for the production of this dangerous condition. The obvious warning implied in these remarks requires no further admonition to impress the fact that the bather in cold water must be economical of time, and free from any appreciable signs of muscular exhaustion.

THE TUNING-FORK IN THE DIAGNOSIS OF EAR AFFECTIONS.—Dr. O. D. Pomeroy of New York, in a paper read before the Medical Society of the State of New York at its last annual meeting, discussed the use of the tuning-fork in the differential diagnosis of ear affections. The fork which he employs is of large size, being eight inches in length. It has thick prongs, and gives a strong vibration. Its pitch is A of the middle tenor register, and it vibrates something over four hundred to the second. He finds that the absolute or total bone-conduction, with the fork placed on the mastoid of a closed normal ear, is as great as can be found in any case of middle-ear disease, and greater than when disease of the labyrinth is present. There are several difficulties in the way of obtaining a reliable test for bone-conduction. One is the inability of many patients to distinguish between vibrations which are felt and those which are heard. Any part of the body susceptible of vibrating in unison with a tuning-fork of a given pitch will feel the vibration without having heard it. Few people who have heard a pipe-organ will fail to remember, that, when some of the lower notes are sounded, a rumbling or a jarring sensation in some part of the body is experienced, which, of course, is not a matter of acoustic irritation, but one of general sensation. In one case of a patient who had suffered from meningitis, which left her totally deaf, when the tuning-fork was applied to the elbow she insisted that she heard it distinctly. Dr. Pomeroy gives the following summary as the result of his study of the subject: "I conclude that the greatest amount of bone-conduction proceeds from a normal ear closed, and that the principal diagnostic sign of labyrinthine disease appears in weakened bone-conduction ; that the apparent increase of bone-conduction in middle-ear disease will disappear when the test is made with the ear closed, when it will be found not to exceed that of the normal ear (in those cases called 'mixed' the bone-conduction will be found weakened when the test is made with the ear closed, although with both ears open the affected one may have better bone-conduction than its fellow) ; that, so far, it seems that the good or bad condition of the middle-ear mechanism has little influence on bone-conduction ; that the occasional phenomenon of intermittent bone-conduction cannot be satisfactorily explained ; that cases of pure labyrinthine disease cannot always be distinguished from those of middle-ear affections with secondary labyrinthine changes by the tuning-fork, and that the history of the cases must materially aid us in the distinction ; that the phenomenon of secondary labyrinthine changes in middle-ear diseases is easily explainable ; that there are numerous exceptions to the rules for finding the best points on the head for eliciting bone-conduction ; that the bone-conduction is rarely or never of less than its proper ratio to aerial conduction."

BOOK-REVIEWS.

Ptomaines and Leucomaines, or the Putrefactive and Physiological Alkaloids. By VICTOR C. VAUGHAN and FREDERICK G. NOVY. Philadelphia, Lea Bros. 12°.

PROFESSOR VAUGHAN and Mr. Novy have done the scientific world great service in collating the facts connected with ptomaines and leucomaines. The literature of the subject is abundant, but has been so scattered and so fragmentary that it was not available for reference. In the book before us a very complete historical sketch of the subject has been given, and for those who wish to consult the original articles which have appeared, a very excellent bibliography is provided. This work is more than a mere compilation. Professor Vaughan has done a large amount of original and valuable work in this branch of scientific research, and his views and methods are here given to the public. In the chapter devoted to the consideration of the foods containing poisonous ptomaines, the authors mention mussels, sausage, ham, canned meats and fruits, cheese, milk, ice-cream, and bread as having been proved at various times to contain poisonous alkaloids. These observations are made the more interesting by being accompanied with the details of the cases, and are of special value to the physician by reason of the detailed symptoms and progress of the illness. The relation of ptomaines to disease is fully discussed. The authors express the view that an infectious disease arises when a specific, pathogenic micro-organism, having gained admittance to the body, and having found the conditions favorable, grows and multiplies, and in so doing elaborates a chemical poison which induces its characteristic effects. In the systemic infectious diseases, such as anthrax, typhoid-fever, and cholera, this poison is undoubtedly taken into the general circulation, and affects the central nervous system. Among the methods of extracting ptomaines, those of Stas-Otto, Dragendorff, Brieger, Gautier, and Etard are described, and preference given to the Stas-Otto, recognizing, however, that this method is not perfect.

Several chapters are devoted to the leucomaines, or those basic substances which are found in the living tissues, either as the products of fermentation changes or of retrograde metamorphosis, as distinguished from ptomaines, or those which are formed during the putrefaction of organic matter. The closing chapter, on the pathological importance of the leucomaines, is full of suggestion to the practising physician. The authors truly say that while the medical profession has been giving much time, attention, and energy in recent years to the study of infectious diseases, it has too much neglected a large and important class of ailments which arise within the body itself, and which may be called autogenous. They believe that the individual may be poisoned by his own excretions, and that bilious attacks, attacks due to torpid livers, etc., are due to the absorption into the general circulation of peptones which are formed faster than the liver can convert them into globulin, and that they act as poisons, or that poisonous alkaloids are formed and absorbed. The opinion is expressed that ordinary colds are due to the retention of certain effete matters which are normally excreted by the skin, and that fevers are often produced in the same manner. This chapter alone is worth the price of the book to the practising physician.

Longmans' School Geography. By GEORGE G. CHISHOLM. London, Longmans, Green, & Co. 12°. \$1.05.

Elementary Physiography. By JOHN THORNTON. London and New York, Longmans, Green, & Co. 12°. 80 cents.

THE endeavors of the Royal Geographical Society of London to improve the methods of teaching geography have resulted in the publication of a great number of text-books, among which Chisholm's work is one of the earliest. The author has adopted the methods of teaching in use in Germany, and followed to a certain extent the models of Wagner's and Supan's geographies. We recommend his book to teachers as suggestive of a good method of teaching geography. It is of particular value on account of the numerous references to an introduction treating mathematical and physical geography. The book contains very few names and figures, but describes the character and productions of the various countries that are discussed briefly. The facts are as a rule accurate, although a few errors occur. The author emphasizes in his preface

that to teach geography adequately the aid of maps is necessary, and therefore many portions of the book must be considered hints to the teacher, not full descriptions of the countries treated. Undoubtedly the present book will be a valuable help to finding a satisfactory method of teaching geography.

Another attempt to improve the methods of teaching geography is Thornton's 'Elementary Physiography.' It does not cover the field of descriptions of countries, but the author treats in a very satisfactory way the problems of physics as applied to the phenomena of our planet. The author has followed the lines of the recast Syllabus recently issued by the Science Department, South Kensington. We believe that the method advocated in this book and in the new Syllabus is capable of the most satisfactory results in the hands of a skilful teacher. If applied consistently, it will lead to the teaching of the various branches of science by observation of the phenomena of nature. It is evident that the teaching of geography on the methods advocated by Geikie and others must necessarily include the teaching of physics, chemistry, botany, zoölogy, and geology, and that it is only a change of name if we call it physiography. All attempts to improve the methods of teaching geography have followed these lines, and we do not doubt that it will finally result in a re-organization of the methods of teaching science. The great advantage of the new method is its being more concrete than the old one, educating the child to observe the phenomena among which it lives, instead of beginning with the experiment. This is, at the same time, a valuable counterbalance against the one-sided training of the faculty of reasoning to which the teaching of science easily leads; the observation of life being a powerful means of educating the love of nature and the feeling of the child. It is principally from this point of view that we welcome Thornton's book, which first discusses physical laws and then applies them to geographical phenomena. From what we have said above, it will be clear that we should prefer the reverse arrangement; but the teacher will, of course, be able to use the book as well in applying physical laws to phenomena as in finding the laws by studying the phenomena. The descriptive part of geography as treated in Chisholm's book ought to be the subject of the teaching of geography proper, which assumes the knowledge of the general laws of physiography. If we define geography in this way, it will be understood that it can best be taught in connection with history, as it treats of countries and their inhabitants. We wish that general anthropogeographical statements were excluded altogether from school-books, as they are always misleading, and promote a superficiality in the way of treating historical and political questions which ought to be avoided. The influence of a country upon the development of its inhabitants is most satisfactorily treated in teaching its history. Chisholm's and Thornton's books will help to remodel the teaching of geography and science so as to make them important branches of our systems of education.

NOTES AND NEWS.

THE quarantine act approved by the President last week provides for the immediate establishment of eight new federal quarantine stations at the following points: one at the mouth of Delaware Bay; one near Cape Charles, at the entrance of Chesapeake Bay; one on the Georgia coast; one at or near Key West; one in San Diego harbor; one in San Francisco harbor; and one at or near Port Townsend, at the entrance to Puget Sound. The aggregate sum appropriated for the establishment and maintenance during the present fiscal year is \$511,500. This extension of the national quarantine service is certain to give the country much better protection than it has ever had against the introduction of infectious diseases.

— William A. Croffut, who has been appointed executive officer of the Geological Survey, in the place of the late James A. Stevenson, is a well-known journalist. He is a man of great energy and an unbounded capacity for work, and will undoubtedly fill with success the difficult position in which he is placed. He has a taste for scientific investigation, and has lately given much attention to the subject of hypnotism, both studying its philosophy and making practical experiments. Mr. Croffut's appointment is especially gratifying to the journalists of Washington, with whom he is very popular.

—The circular of the New York Mineralogical Club, with its programme of Saturday afternoon field-meetings during June and July, was widely distributed, and aroused much interest, not only among the membership of the club, but among many others engaged in kindred studies. The trips taken have been both pleasant and profitable, and have been attended by increasing numbers. A second circular has been issued, in the belief that it will not alone afford the club further opportunities of useful study and agreeable intercourse, but tend yet more to bring together the workers in allied fields. Several other scientific societies and circles have expressed a wish and purpose to join in some of the proposed trips, and the club has already enjoyed the company of a number of friends and co-workers.

—Cupples & Hurd will publish at once a cheap edition of 'The Story of an African Farm;' also an illustrated guide to the Island of Bermuda, by James H. Stark. — Ginn & Co. will publish early next month 'Footprints of Travel, or Journeying in many Lands,' by Maturin M. Ballou. The purpose of this work is to furnish a reader for use in public schools. — Stuart Cumberland, the 'thought-reader,' is about to publish a volume on 'Famous Men I have known.' — Mr. George Redway, London, who has made a specialty of this class of literature, announces an 'esoteric' series, to consist, for the most part, of reprints of old books dealing with alchemy, astrology, freemasonry, magic, and Rosicrucian mysticism. Among the first to appear will be the works of the anonymous cosmopolite philosopher, known as Eireneus Philalethes; and the 'Lumen de Lumine' of Thomas Vaughan, who wrote under the name of Eugenius Philalethes. — Henry Stevens & Son, London, have in press a volume entitled 'Americanisms, Old and New: a Dictionary of Words, Phrases, and Colloquialisms Peculiar to the United States, British America, the West Indies, etc.; their Derivation, Meaning, and Application, together with Numerous Anecdotal, Historical, Explanatory, and Folk-Lore Notes, and a Critical Introduction,' compiled and edited by John S. Farmer, author of 'Ex Oriente Lux,' 'Twixt Two Worlds,' etc. The book will be printed for private circulation among a limited number of subscribers only. — The Reform Club has begun, at 52 William St., New York, the publication of a semi-monthly journal of handy dimensions, called *Tariff Reform*. — The July issue of the *Westminster Review* (Leonard Scott Publishing Company) has articles of cosmopolitan interest on 'Nurses and Nursing;' 'Mental Deterioration, Some of its Avoidable Causes;' and 'Characteristics of American Cities.' — The *Cosmopolitan Magazine*, the publication of which was suspended last May, will now be issued monthly by a new company. Mr. J. N. Hallock, of *The Christian at Work*, is a member of the new company, and the editorial department will be conducted by Mr. E. D. Walker. — The *Journal of Pedagogy*, Athens, O., beginning with No. 11 of Vol. I., will contain from twenty to twenty-four pages of reading-matter, instead of sixteen as heretofore. — In the *Century* for August, Professor Holden begins his series of two articles on sidereal astronomy, old and new. The one now given briefly chronicles the data which astronomy has collected up to date: it tells of the methods of naming the stars, their number, the star charts, catalogues, etc. These articles are appropriate to the star-gazing season. — In the *Andover Review* for August the opening article is by Morrison I. Swift, Esq., who treats of the duty of society with reference to 'trusts.' He states the objections to such combinations, reviews proposed methods of treatment, and argues intelligently for their 'acceptance and thoroughgoing regulation.' Rev. Francis H. Johnson contributes a criticism of methods of harmonizing Christianity and science by sacrificing the distinctive characteristics of the former as a divine revelation. — In the midsummer issue of *The American Magazine*, Dr. W. F. Hutchinson presents the fourth of his illustrated articles in the series 'Along the Caribbean,' in this instance dealing with Trinidad; and Frederick G. Schwatka tells about 'The American Arctic Savage.' — Ticknor & Co. have ready 'A History of Presidential Elections,' by Edward Stanwood.

—According to *Agricultural Science*, Prof. W. P. Brooks, at present president of the Imperial College of Agriculture, Sapporo, Japan, is to be the next professor of agriculture at the Massachusetts Agricultural College. Professor Brooks went to Japan about

twelve years ago to teach agriculture in the newly started college. Later he became its president. He is considered one of the ablest graduates of the Massachusetts Agricultural College, and his selection for the place in question is for many reasons a wise one. Professor Brooks was born in 1851.

—In accordance with the provisions of the constitution, the committee of the Nineteenth Century Club has selected from the list of vice-presidents Mr. Daniel G. Thompson as president, to fill Mr. Palmer's unexpired term.

—The American Statistical Association recently issued the first number of its Proceedings, on 'Statistics of Water-Power,' by G. F. Swain. This association has been organized and maintained for nearly half a century; up to this time, however, it has been almost entirely a local society of Boston. It now desires to extend its scope, so as to make its interests and influence national. It is intended in an early number of the publications to begin a record of statistical publications in various departments of knowledge, — a record which it is hoped will be a serviceable guide.

—The Middlesex Institute, Malden, Mass., has issued 'Flora of Middlesex County,' by L. L. Dame and F. S. Collins. The authors acknowledge their indebtedness to Dr. Gray, Dr. Farlow, and other leading botanists.

—It is now seven years since the International Geographical Congress at Venice adjourned, and it seemed as though these important conventions which have proved so fruitful for the promotion of geographical investigations were totally abandoned. It is therefore with great pleasure that we learn of the plan of the French Geographical Society to convene an international geographical congress during the universal exhibition that is to be held next year. Each society represented at the congress will be invited to submit a report on the progress of geographical work in the country to which it belongs, during the last century, and this plan promises to yield interesting and valuable results.

—Since the report of Dr. Elkin to the Board of Managers of the Observatory of Yale University in 1887, the series of observations on the parallaxes of the ten stars of the first magnitude in the northern hemisphere has been brought to a close. The average or mean parallax of the stars is $+0.085 \pm 0.015$, to which should probably be added $+0.004$ as the probable parallax of the comparison stars which are in the mean of about the eighth magnitude, giving $+0.089 \pm 0.015$ for the result sought for. Dr. Elkin does not, however, in view of the wide range of distance implied by the values of his table, feel at all certain that this result may be taken as a measure of the average distance of the stars in question, and at all events it must be considered only as provisional and partial until it can be combined with the result for the first-magnitude stars of the southern hemisphere, now in course of determination by Dr. Gill. At the same time he draws attention to its near coincidence with the values derived by Gylden (0.084) and Peters (0.102), without laying too much stress on this agreement.

—Arrangements have been made for re-determining the difference in longitude between Paris and Greenwich. The geodetic station at Montsouris, which has already been connected with the principal European surveys, will be used for the French observations, and Greenwich Observatory for the English.

—The length of pipe laid in Paris for the distribution of power by compressed air already exceeds 30 miles. The compressing-engines are of 3000-horse power, and about 3,000,000 cubic feet of air are compressed daily to a pressure of 80 pounds per square inch, at an expenditure of 50 tons of coal.

—In the last number of the *Zeitschrift für Hygiene*, under the title of 'Experimente über die bacterienfeindlichen Einflüsse des thierischen Körpers,' Dr. George Nuttall of San Francisco publishes some interesting results of a large number of experiments made by him in Flügge's laboratory during the past year and a half. He finds that freshly drawn blood, humor aqueus, pericardial fluid, and in the case of man also pleuritic exudate, have the power of killing off bacteria to an astonishing degree, but only for a period of three to four hours after removal from the body. The blood of various animals acted differently; for instance, that of an immune sheep killed off four times as many anthrax bacilli as that

of a sheep not rendered immune against the disease; the blood of the rabbit killed off many bacteria, more, in fact, than the blood of sheep, sheep being, as is well known, much more susceptible to the disease than rabbits. On the other hand, the blood of a mouse had no visible effect on bacilli, in the latter case the animal being extremely sensitive to the disease. That the animal cells do not play any thing like the active rôle frequently assigned to them ('Phagocyte' theory of Metschnikoff and followers) is pretty clearly shown, it being found that the bacteria die off quite independently of the cells or leucocyte in and out of the body. Of saprophytic bacteria some forms are found more sensitive than others. Fluids taken from various individuals of the same species vary to some extent in their germicidal qualities. To give an idea of the intensity of this action, a case or two might be cited. Five drops of defibrinated rabbit's blood, placed at 37-38° C., reduces the number of anthrax bacilli inoculated into it from about 15,000 to 5 at the end of an hour; in another case, from about 90,000 to 0 at the end of four and five hours. Rabbit humor aqueus (contains little or no cellular elements) reduces the number of anthrax bacilli inoculated into it from about 10,000 to 1, and in another case to 0, at the end of two hours; in fresh human pleuritic exudate, 230 anthrax bacilli are entirely killed off after one and two hours. Human saliva was also found to kill off large numbers of bacteria in a short time. The encouraging of bleeding, and the sucking of a wound in certain cases, may not be bad treatment, after all, when we consider the result of the above experimental research.

— Prof. F. W. Clarke describes, in a contribution to the *American Journal of Science*, the results of a series of investigations into the manner of formation of nickel silicates. About the year 1881 extensive deposits of this ore were found in Douglas County, Oregon. They lie near the surface in beds from four to thirty feet thick, and no second beds have been found underlying the first. Most of the samples obtained are intermixed with oxides of iron and with quartz, and are seamed with chalcedony. All of them are undoubtedly products of alteration, which is true of similar samples procured from the deposits in New Caledonia and in North Carolina. The country rock in these three localities is almost identical, consisting of a greenish rock, composed of olivine partially altered into serpentine, and having considerable quantities of enstatite mingled with it. The only noticeable difference in occurrence was that chromic iron, an almost universal associate of the nickel silicates, is absent in Oregon. Analyses of these various ores show great dissimilarity in composition, even between specimens from the same deposit. The percentage of nickel oxide varies from 0.24 to 45.15 per cent, but magnesia is present sometimes to the extent of 22 per cent, and this would lead to suspicions that alteration in the olivine, which is a silicate of magnesia and iron, had something to do with it. Actual analyses of the olivine rock confirmed at least the existence of nickel in it, varying in quantity from 0.10 to 0.26 per cent. Mr. Clarke quotes Dr. T. Sterry Hunt as saying that nickel is almost always present in small quantities in olivine, and rarely absent from the serpentines, steatites (soap-stones), and allied minerals of the Quebec group. As a result of these investigations, Mr. Clarke concludes that the olivine, which always occurs with these ores, and which so readily alters, has supplied the nickel which is found as silicate, not only in Oregon, but at other localities so far observed.

— Those who are obliged frequently to refer to German books are especially interested in the movement to introduce the Roman in place of the Gothic alphabet. Since 1866 the society which is agitating this matter has nearly doubled in numbers. On its lists are now over 4,436 names, including members of all professions, teachers, physicians, booksellers, and merchants. In 1886, out of 6,913 books on artistic, scientific, mercantile, and industrial subjects, 5,316 were printed with the Roman letters.

— J. N. Emra, late lieutenant Royal Marines, has issued a little book (London, Kegan Paul, Trench, & Co.; New York, the author) descriptive of the cruising of H. M. S. 'Royal Oak' in the waters of the Mediterranean. The author calls his book 'The Centre of the Central Sea,' and devotes himself to Malta, Sicily, and an ascent of Mount Etna by some of the officers, describing the phenomena of the volcano as he saw them.

LETTERS TO THE EDITOR.

Our Native Birds.

AN editorial paragraph in your issue of Aug. 3 assumes that our native birds have this season been unusually abundant; the assumption being based, so far as appears, upon statements "in the New York papers" and upon "information from Illinois," where "the oldest inhabitant does not remember to have seen so many and such a variety of birds." This is good news, — almost too good, — and, for one, I could wish it better vouched for.

In this part of the country, according to my own observations. (and I have never been more in the field than this year), there has been no such state of things, either during the migratory movement or since. There are days in April, and again in May, as every ornithologist knows, when the woods and fields are fairly alive with migrants. That was true this year, but no truer than it is every year.

This piece of negative evidence proves nothing, of course; and I should hardly have thought it worth offering had even one ornithologist been named as authority for the fact in question. But in such matters mere newspaper reports seem to me of small account, while my acquaintance with the oldest inhabitant of Massachusetts does not incline me to put unqualified faith in the opinions of the oldest inhabitant of Illinois as to the comparative abundance either of individual birds or of species.

In short, I am suspicious of the testimony, and therefore of the facts; but if the facts can be established, then I join you in hoping that the editors of the *Auk* will favor us with an explanation. As for the one already suggested (by "the New York papers," as I infer), it is plainly insufficient, in more ways than one. If the English sparrows were largely or wholly destroyed, it would be an occasion for thankfulness (I speak for myself); but the supposition that their destruction in March would be followed by a great increase in the number of our native birds within two or three months seems to me very unreasonable. BRADFORD TORREY.

Melrose Highlands, Mass., Aug. 5.

REFERRING to the editorial note in your issue of Aug. 3, the failure of ornithological journals to comment on the apparent increase in bird-life during the present season is perhaps an evidence that such comment is uncalled for. It is true that during the vernal migration there was at one time an unusually heavy 'wave' of migrants, the north-bound stream being held in check for several successive days by unfavorable weather. This obstacle being removed, and pleasant weather succeeding, there resulted an overflow of past-due birds, which flooded the country in such accumulated numbers as to excite remark by the most unobservant, as the numerous articles in the daily press of that period will testify.

The migration over, and our avifauna being sifted down to purely summer resident species, a comparison of the number present with those of preceding years yields, so far as my own observations go, remarkably similar results. To illustrate: I find recorded in my note-book on Aug. 5, 1886, observations on thirty-one species observed during a morning's walk. Of these, eight are given as 'common,' three as 'tolerably common,' and the balance as 'two or three,' 'three or four,' etc.; and on Aug. 7, 1887, thirty-five species, of which ten are recorded as 'common,' ten as 'tolerably common,' and the balance as in the preceding; while on Aug. 5, 1888, the result of a walk over exactly the same district was thirty-three species, ten being 'common,' three 'tolerably common,' and the balance as before.

Local observations of this nature, however, can do little more than assist in making a whole, and only from a mass of comparative data can we assert that the number of individuals composing our avifauna during the present year is greater or less than in years preceding.

FRANK M. CHAPMAN.

Englewood, N. J., Aug. 5.

The Relation between the Sourness of Certain Acid Solutions and the Amount of Acid contained.

THE experiments recorded below are a continuation of some studies on the delicacy of the special senses, by Prof. E. L. Nichols and myself and Mr. E. C. Franklin and myself, the results of which have appeared in *Science*, *Nature*, the Proceedings of the Kansas Academy of Science, and elsewhere. By these investiga-

tions the present line of inquiry was suggested. The question raised was, have all acids that have the same alkali-neutralizing strength the same sourness to the taste? For purposes of testing, a number of 'normal' solutions were made. Thus, for

Sulphuric acid, 1 litre contained	49.0 grams.
Hydrochloric " " " "	36.5 "
Nitric " " " "	63.0 "
Tartaric " " " "	75.0 "
Citric " " " "	64.0 "
Acetic " " " "	60.0 "

The solutions were then of such strength that one cubic centimetre of each would exactly neutralize one cubic centimetre of a normal solution of carbonate of soda.

These solutions were then diluted so that in each series one bottle was of one-half the strength of the preceding one. Of course, a point is soon reached where the acid is so dilute that it is impossible to recognize its presence by the sense of taste. The bottles containing these acids, and some bottles containing only water, were placed without regard to order, and the experimenter was requested to separate into two groups acid and water by tasting the solutions. Those who had the sense of taste more thoroughly developed would be expected to taste the more dilute of the acids. No attempt was made to distinguish between the different kinds of acids. The best method has been found to be to test the solutions rapidly, and pick out the samples about which there could be no doubt, and then to go more carefully over the rest a second time.

In order to obtain the average taste, tests were made by twenty persons, including both sexes and different ages. As the acids are of different apparent strength, the solution of the acids is best seen by a comparison of the most dilute solution tasted in order of strength. This can best be shown by a comparison of the numbers of bottles tested; viz.,—

Sulphuric acid, 7.2	Tartaric acid, 6.5
Hydrochloric " 7.0	Citric " 6.8
Nitric " 7.1	Acetic " 6.8

These results agree as closely as could be expected, especially when we consider the unprejudiced position of the experimenter. It will be noticed that the general average of the mineral is a little higher than that of the organic acids. This may be due to a more persistent and characteristic taste in the former. There seemed to be greater uniformity in the tests for sulphuric acid than for any other, as only four detected any acid in the eighth dilution, and none failed to notice it in the seventh. The amount of acid detected, of course, varies with the molecular weights, but the average limit of delicacy is about one part in two thousand parts of water.

For these tests the solutions were frequently renewed. In one case they were allowed to stand for three weeks, when it was found that the three organic acids had lost about all their strength, and at the same time a variety of microscopic organisms had developed at the expense of the acid. These algæ were different in each acid, though some of the same species were found in all. The examination was kindly made by my friend Mr. V. L. Kellogg. It may not be in place to give here the details of this examination, but only to suggest that a great field of investigation lies open in the direction of these lower orders of life and their relation to the destruction of chemically pure substances.

In conclusion, it seems to be true, from what has been stated above, that all acids having the same alkali-neutralizing power are equally sour to the taste, and that the solutions of organic acids rapidly lose their strength.

E. H. S. BAILEY.

Lawrence, Kan., July 27.

Beware of the Deadly Alternating Electric Current.

At the School of Mines of Columbia College this morning, at eleven o'clock, experiments were undertaken, at the request of Harold P. Brown, electrical engineer, to determine the danger of alternating currents, by Dr. Cyrus Edson and Dr. Charles F. Roberts of the New York Board of Health.

The first dog operated upon was a mongrel dog weighing 61 pounds, strong, and in good condition. His height was 24 inches; length from tip of nose to base of tail, 42 inches; and resistance from the right front leg to the left hind leg, 14,000 ohms. Connection was made by binding a piece of cotton waste saturated with water round the leg with No. 20 bare copper wire. The dog was

placed in a cage, and the alternating current applied by Dr. Roberts at 272.16 volts for five seconds; number of alternations, 288 per second. The dog was silent and motionless during the continuance of the current. He gave a few spasmodic gasps thirty-one seconds after current was first applied, and heart ceased beating ninety seconds after current was applied. The dog was immediately dissected by Dr. Roberts and Dr. Peterson, and section of sciatic and pneumogastric nerves, muscular fibres of diaphragm, and lungs, placed under a microscope, and no changes in structure were observed.

The second dog was a full-blooded Newfoundland, strong, and in good condition, weighing 91 pounds; length from tip of nose to base of tail, 48 inches; height, 25 inches; resistance, 8,000 ohms. Connection was made in the same manner as above. Alternating current applied by Dr. Roberts at 340.5 volts electro-motive force for five seconds. The dog was silent and motionless during continuance of current, howled and gasped for eight seconds after circuit was opened; but, in the opinion of physicians present, this was pure mechanical action, as the dog was unconscious from the instant the current first reached him. Heart stopped beating in two minutes and fifty seconds after current was first applied.

The third dog was a half-breed setter and Newfoundland, weighing 53 pounds, 42 inches long from tip of nose to base of tail, and 24 inches high; resistance, 30,000 ohms. Connections were made in the same way as before. Dr. Roberts applied the alternating current at 220 volts for five seconds. The result was not fatal at four minutes afterwards. Mr. Porter, superintendent of machinery of Columbia College, then suggested, that, as the dog was rigid and motionless during the continuance of the shock, it would be impossible for a man in the same conditions to utter a sound or to break the contact in five seconds. Dr. Edson then determined to administer the current at same number of volts for thirty seconds on this account, and on account of the high resistance of this subject. This was done, and during the period of the thirty seconds the voltage rose to 234. The dog died instantly without sound or struggle. The resistance after death was found to be 2,800 ohms.

All the physicians present expressed the opinion that a dog had a higher vitality than a man, and that therefore a current which killed a dog would be fatal to a man under the same conditions. It was their opinion that all of these deaths were painless, as the nerves were probably destroyed in less time than that required to transmit the impression to the brain of the subject.

Dr. Edson invited Prof. Elihu Thomson of Boston, and Dr. Otto A. Moses, to be present with measuring-instruments to check up the voltage, etc.; but neither of these gentlemen put in an appearance or responded.

Dr. CYRUS EDSON, *Pres. Board of Health.*

Dr. CHARLES F. ROBERTS, *Asst. Prof. Physiol.,
Bellevue Hospital Medical College.*

Dr. FREDERICK PETERSON.

Dr. FRANK H. INGRAM.

Dr. H. A. HAUBALD.

Dr. SCHUYLER S. WHEELER, *Electrician Board
of Electrical Control.*

HAROLD P. BROWN, *Electrical Engineer.*

Mr. JOHN MURRAY MITCHELL.

Prof. C. E. COLBY, Columbia College.

Capt. E. L. ZALINSKI, U.S.A.

Prof. L. H. LAUDY, Columbia College.

New York, Aug. 3.

Note on Breeding-Habits of the Bill-Fish (*Tylosurus longirostris*).

ON the 25th of June last my attention was called by Mr. Ulric Dahlgren of this city to the fact that very young specimens of the bill-fish were to be found in large numbers in the 'feeder' of the Delaware and Raritan Canal, north of the town. A few days later I obtained many specimens, and their size at once showed that they had been hatched at the locality where found. In fact, many still showed traces of the yolk-sac.

So far as I have been able to ascertain, there has been no previous record of the fact that this fish breeds in fresh water, the impression with ichthyologists being that they never deposited their eggs beyond salt-water limits.

CHARLES C. ABBOTT.

Trenton, N. J., July 31.